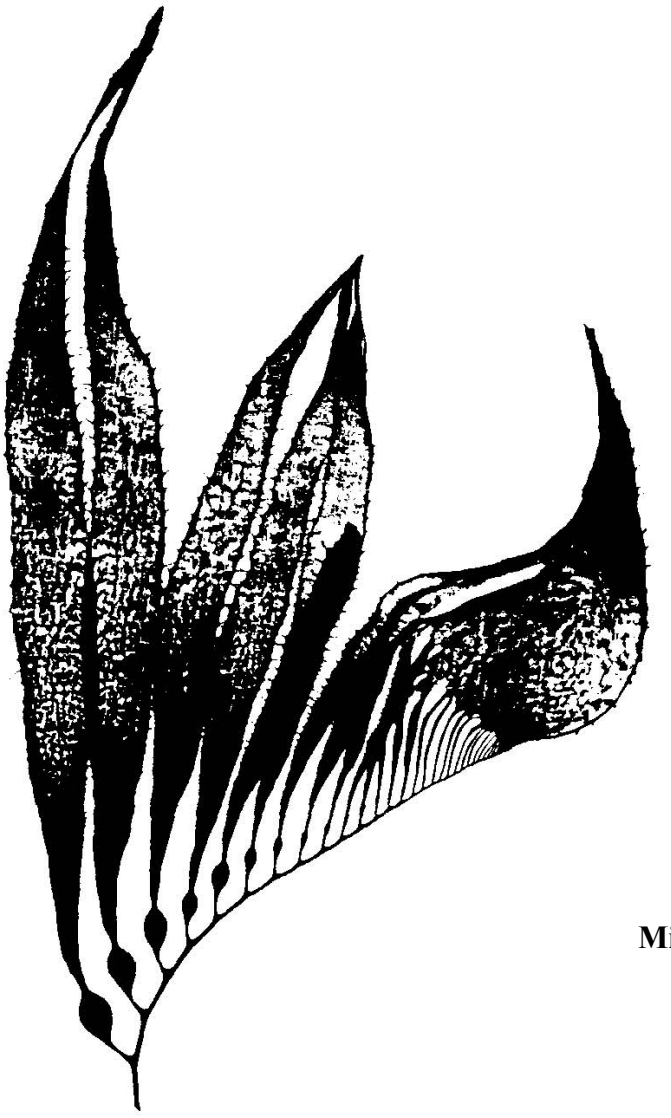
COASTAL MARINE INSTITUTE

PROGRAM YEAR 8

QUARTERLY REPORT 3

for the period

January 1, 2002 – March 31, 2002



A Cooperative Program
between the
University of California
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Minerals Management Service

April 16, 2002

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Russell J. Schmitt
Program Manager

Coastal Research Center
Marine Science Institute
University of California
Santa Barbara, California 93106

April 16, 2002

Program Manager's Report

for the period January 1, 2002 – March 31, 2002

This constitutes the quarterly report for the third quarter for Program Year 8 of the Coastal Marine Institute, a cooperative research agreement between the Minerals Management Service, the state of California and the University of California. As of this quarter, 16xx projects currently are being conducted under the aegis of the Coastal Marine Institute.

Actions Pending MMS Approval:

- Approval of no cost extension for Task 17603, Contract No. 14-35-01-00-CA-31063, PI Murray, *Shoreline Inventory, Orange County*
- Approval of no cost extension for Task 10596, Contract No. 14-35-0001-30758, PI Schmitt, CMI Management;
- Approval of no cost extension for Task 14181, Contract No. 14-35-0001-30758, PIs Schmitt & Brooks, *Population Trends and Trophic Dynamics ...*;
- Approval of no-cost extension for Task 17608, Contract No. 14-35-01-00-CA-31063, PIs Washburn & Gaines, Observing the surface circulation …;
- Approval of no-cost extension for Task

Major Programmatic Progress and Actions during the Quarter:

- Pre-proposals have been received for 6 projects. The proposals were reviewed by UCSB and MMS personnel and full proposals have been requested;
- The Final Report for Task 13096: *Utilization of Sandy Beaches by Shorebirds: Relationships to Population Characteristics of Macrofauna Prey Species and Beach Morphodynamics*, has been completed. It will be submitted to MMS as soon as the manuscript containing the data has been submitted for publication;
- Task 13094: *Application of Coastal Ocean Dynamics Radars for Observation of Near-Surface Currents off the South-Central California Coast*, has been completed and the draft final study report will be submitted to MMS next quarter;
- Task 13095: *Effects of Produced Water on Complex Behavioral Traits of Invertebrate Larvae and Algal Zoospores,* has been completed and we received the draft final study report on December 27, 2001. The Draft Report will be formatted and submitted to MMS for review next quarter;
- Task 15116: *Wave Prediction in the Santa Barbara Channel*, has been completed and the final study report has been submitted to MMS;
- Task 15117: *Assessing Toxic Effects on Population Dynamics Using Individual-Based Energy Budget Models*, has been completed and the final study report has been submitted to MMS.

- **Task 15118:** *An Experimental Evaluation of Methods of Surfgrass (Phyllospadix torreyi) Restoration Using Early Life History Stages*
- **Task 17603:** *Following Changes in the Abundances of Rocky Intertidal Populations in Orange County, California: Contributions to a Regional Monitoring Network*
- Task 17610: ***Industrial Activity and Its Socioeconomic Impacts: Oil and Three Coastal California Counties***

Task 12387: *Ecological Consequences of Alternative Abandonment Strategies for POCS Offshore Facilities and Implications for Policy Development*

Principal Investigators: Mark H. Carr, Department of Biology, University of California, Santa Cruz, CA 95064, **Graham E. Forrester,** Dept. of Biology, University of Rhode Island, Providence, RI, and **Michael V. McGinnis,** Coastal Research Center and Ocean and Coastal Policy Center, Marine Science Institute, University of California, Santa Barbara, CA 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

xxWe continued to focus our efforts on writing the final report and associated publications this past quarter. The primary tasks conducted this past quarter were:

- Preparing text, tables and figures for the final report and publications.
- Reanalysis of fish densities on platforms, based on exact dimensions of platform structure that we finally obtained.

Future plans: Preparation of final report and publications.

Estimated Percentage of Budget Expended:

Project Year 1 100%
Project Year 2 100%
Project Year 3 100%

Task 14181: *Population Trends and Trophic Dynamics in Pacific OCS Ecosystems: What Can Monitoring Data Tell Us?*

Principal Investigators: **Russell J. Schmitt,** Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106 and **Andrew J. Brooks,** Coastal Research Center, Marine Science Institute, University of California, Santa Barbara, CA 93106

Progress to Date:

A number of entities (including MMS) have devoted considerable effort and resources to the long-term monitoring of various components of the coastal marine ecosystems in the Southern California outer-continental shelf (OCS) region. The primary goals of such monitoring are to estimate the current state of the biota and to identify long-term trends in population demographics. Data from such studies are vital to resource and regulatory agencies as they provide critical baseline information needed for accurate assessment of potential effects arising from such particular activities as offshore oil and gas production. The fundamental need for such information is evidenced by the growing number of coastal marine monitoring programs that have been implemented in Southern California.

Our MMS-UC CMI funded research encompasses two separate objectives: (1) the analysis and synthesis of existing long-term monitoring data and (2) the continued annual surveys of subtidal reef communities at Santa Cruz Island.

(1) The analysis and synthesis of existing long-term monitoring data.

To date we have analyzed 8 separate datasets collected in three different ecological systems; subtidal rocky reef, kelp bed, and open ocean pelagic. Trends in population abundances show consistent declines in all three systems over the last 10-15 years. Most interesting, within each system examined, trends for each component trophic level show approximately the same degree of decline. This pattern holds across spatial scales ranging from a single island within the northern Channel Islands group to the entire Southern California Bight. Also interesting is the fact that data collected using extremely different methodologies, e.g. coastal power plant impingement studies versus diver visual surveys, provide similar estimates of the magnitudes of these declines. Most recently, we conducted time-series analyses on these data sets to describe their temporal trends and explore the timing and magnitude of change. The species examined were classified as to trophic level, mode of reproduction, extent of geographic range, association with benthic or pelagic food webs, and habitat. In general, the magnitude of decline was similar for all species, regardless of classification. Trends were similar at all locations examined within the Bight, suggesting regional declines in abundances rather than redistribution of individuals. These patterns are consistent with the explanation that a regional decline in productivity is responsible for regional decline in fish stocks.

(2) The continued annual surveys of subtidal reef communities at Santa Cruz Island.

We are finishing the process of identifying epifaunal invertebrate samples collected during our 2001 surveys. We also have continued with our monitoring of the abundances of surfperches, their invertebrate prey, and the algal cover present in benthic microhabitats at 11 permanent study sites on the south coast of Santa Cruz Island. Sampling of fish (via visual counts along permanent band transects) and algal cover (via random point contact methods) were accomplished in the manner described in our proposal. Epifaunal invertebrates collected from three of these sites have been rough sorted and preserved for later taxonomic identification. We were able to complete sampling at all of our study sites in 2001.

Publications and Presentations:

Brooks is scheduled to participate in an upcoming symposium at the Southern Academy of Sciences Meetings in June, 2002. We have one publication in the Journal of Marine and Freshwater Research [Brooks, A.J., R. J. Schmitt and S. J. Holbrook. 2002. Declines in regional fish populations: have different species responded similarly to environmental change? Marine and Freshwater Research 53(2):189-198.] and are currently preparing two additional papers for publication.

List of all personal associated with the project this quarter

PIs: Dr. Russell J. Schmitt, Dr. Andrew J. Brooks
Post-graduate researchers: Keith Seydel, Andrea DeMent
Undergraduate researchers: Jada-Simone White, Corine Kane, Julie Deter

Estimated Percentage of Budget Expended:

Project Year 1 100%
Project Year 2 77%xx

Task 15115: *Effects of Temporal and Spatial Separation of Samples on Estimation of Impacts*

Principal Investigator: Peter Raimondi, Department of Biology, University of California, Santa Cruz, CA 95064

Major Accomplishments, January 1, 2002 - March 31, 2002

Progress has been made towards the final report, which will be submitted next quarter.

A major accomplishment has been achieved this quarter with the acceptance of a paper entitled "Continued declines of black abalone: Are mass mortalities related to El Niño event?" in the journal *Marine Ecology Progress Series*.

Below are the main questions proposed by the project and progress to date.

Question 1: What are the spatial and temporal patterns in the structure of the monitored communities at all 25 monitored sites?

These patterns have now been documented.

Question 2: Should there be any modification to the sampling regime employed at the various sites?

The detailed and complex statistical analyses continue. Addressing this question awaits the outcome of all analyses, which are still in progress.

The final report is being prepared based on results to date.

Problems Encountered:

The person primarily responsible for the completion of the project has left the University of California, Santa Cruz and taken on a faculty job at another university; this has led to major delays in completion of the project.

Future plans:
1. Finalize statistical analyses.
2. Complete final report.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	100%

Task 15118: *An Experimental Evaluation of Methods of Surfgrass (Phyllospadix torreyi) Restoration Using Early Life History Stages*

Principal Investigators: Daniel C. Reed, Marine Science Institute, University of California, Santa Barbara, CA 93106 and **Sally J. Holbrook,** Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

We our analyzing data and preparing a manuscript for publication. Our graduate student, Scott Bull has finished his research and is in the final stages of writing his Master's thesis. We anticipate that he will graduate in Spring 2002. His thesis will comprise most of the final report.

Future Plans:

We will submit a final report on the findings of our project by June 30, 2002.

Estimated Percentage of Budget Expended:

Project Year 1 100%
Project Year 2 100%
Project Year 3 100%

Task 17601: *Habitat Value of Shell Mounds to Ecologically and Commercially Important Benthic Species*

Principal Investigators: Mark Page, Marine Science Institute, **Jenifer Dugan**, Marine Science Institute, and **James Childress,** Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

The focus of work during this reporting period concerned refining methods to compare the short-term growth rate of selected invertebrates and fishes among habitats using RNA/DNA ratios in animal tissues. This included the development of standard curves with commercially available RNA and DNA preparations. Nucleic acid concentrations in sample tissues can be extrapolated from these standard curves. Fish and invertebrate tissues collected in Fall 2001 will now be assayed for RNA/DNA ratios. Analysis also continued on crab abundance data collected in Fall 2001 from four habitat types: shallow shell mounds at the former sites of oil platforms (~ 30 m), deep shell mounds at the former sites of oil platforms (~ 45 m), deep shell mounds beneath existing oil platforms (~ 47 m), and deep soft bottom (~ 49 m). The sex ratio of *Cancer antennarius* and *Cancer anthonyi* differed significantly among habitats. For *C. antennarius*, male crabs comprised about half the populations on the deep shell mounds (0.56) and shallow shell mounds (0.48), but proportions differed significantly from 0.50 at shell mounds beneath existing platforms (0.26) and deep soft bottom (0.79). No *C. anthonyi* were captured on shell mounds beneath platforms. The proportion of male *C. anthonyi* was significantly different from 0.50 on soft bottom (0.28), but not on deep shell mounds (0.31) or shallow shell mounds (0.46).

Preparation of a manuscript for publication and Masters thesis was begun.

Upcoming work

Frozen tissue samples of invertebrates and fishes will be assayed for RNA/DNA ratios. Soft bottom sites adjacent to shallow shell mounds will be sampled by divers. Work will continue on the Masters thesis.

Estimated Percentage of Budget Expended:

Project Year 1 100%
Project Year 2 5%xx

Task 17602: *Inventory of Rocky Intertidal Resources in Southern Santa Barbara, Ventura and Los Angeles Counties*

Principal Investigator: Richard F. Ambrose, Department of Environmental Health Sciences and Environmental Science and Engineering Program, University of California, Los Angeles, CA 90095-1772

Major Accomplishments, January 1, 2002 - March 31, 2002

During this quarter, the bulk of our efforts revolved around the planning and partial execution of the Spring 2002 sampling, as well as miscellaneous tasks relating to the project as a whole. Spring sampling occurred throughout the month of March (Table 1), although additional sites are still scheduled for April. Sampling proceeded smoothly at all sites with no significant problems. The seals were absent from the rocks at Carpinteria this season, which allowed the mussel plots and seastar transects to be sampled.

Table 1. Spring 2002 Sampling Schedule

Date	*Location*	*Personnel*	*Comments*
March 24	Point Fermin	Steven Lee, Sean Bergquist, Katie Arkema	UCLA personnel only No MMS help
March 25	Paradise Cove	S. Lee, S. Bergquist, K. Arkema, Meera Venkatesan, Ann Bull, Herb Leedy	UCLA personnel with MMS help
March 26	Carpinteria	S. Lee, S. Bergquist, K. Arkema, A. Bull,	UCLA personnel with MMS help
March 27	Alegria	S. Lee, K. Arkema, Mary Elaine Dunaway, Mike McCrary, H. Leedy	UCLA personnel with MMS help
March 28	Arroyo Hondo	S. Lee, S. Bergquist, K. Arkema, A. Bull, Mark Pearson, Laura O'Shea	UCLA personnel with MMS and SB County help
April 06	Coal Oil Point	S. Lee, Stevie DeJong	UCLA personnel with UCSB help
April 08	White's Point	S. Lee, S. Bergquist, K. Arkema	UCLA personnel only
April 22	Old Stairs	S. Lee, S. Bergquist, K. Arkema, A. Bull,	UCLA personnel with MMS help
April 23	Mussel Shoals	S. Lee, S. Bergquist, K. Arkema, A. Bull, M. Pearson	UCLA personnel with MMS help

New plots were established this season at two of the sites. At Alegria, we established and sampled three seastar irregular plots. These plots were located just offshore of the mussel plots and encompass the series of high-relief rock outcroppings that exist there. The two contiguous surfgrass transects that were established during the previous sampling season were used as the inshore boundary of these plots and several

new bolts were installed to delimit the remainder of the plots. Several deep tidepools occur within these new seastar plots, which may prove problematic in the future. The decision was made to include seastars seen within these pools and to estimate sizes where appropriate. Good water visibility during this initial sampling made this possible. Another approach would be to sample only those seastars occurring above the waterline of the tidepools since, presumably, the level would be the same year after year. The three surfgrass transects were sampled for the second time this season.

Three new seastar plots were also installed and sampled at Paradise Cove along the main bench that contains the mussel plots. These new plots were set up in a contiguous fashion, starting near the M1, M2 and M3 photoplots, and extend well offshore of the M4 and M5 plots. Several deep cracks occur in these new plots, in which many (~100) seastars were present.

Thorough photographs, inter-bolt measurements, and site notes were taken for both of these new seastar plot locations. We investigated possible additions at the other sites this season and concluded the following: Arroyo Hondo has no potential for expansion, Coal Oil Point could support mussel photoplots, and possibly barnacle plots, Carpinteria is at maximum effort capacity, White's Point might support seastar plots, and Point Fermin might support seastar plots. At Carpinteria, we sampled the new *Lottia gigantea* plots for the second season. At Carpinteria and Alegria, motile invertebrates were again sampled within *Pollicipes* plots, and within *Balanus* plots at White's Point. Sampling of littorines is still limited to the *Chthamalus* barnacle plots. The motile invertebrate sampling continues to be labor intensive and will probably be subject to future data gaps if our labor force dwindles.

MMS personnel continue to provide sampling assistance. Steven Lee continues to be the primary technician on this project, with the core group of UCLA technicians including Sean Bergquist and Katie Arkema.

This season marked the second use of our new site description page. The new page represents a significant improvement over the previous versions, but there are still some problems with using this form. We are continuing to work on the creation of a new site description sheet that is based on presence/absence and abundance class data for multiple taxa rather than just the ones we currently monitor. A draft of this new form should be ready by the Fall 2002 sampling season.

During this quarter, a meeting was held at UCSB wherein the various groups discussed the standardization of datasets and protocols with a representative from SCCWRP who will be helping with the standardization process. Steven Lee represented the UCLA group in this meeting.

Future Plans:

Throughout the present quarter, the remainder of the Spring 2002 sampling will be executed and then data and photographic image management will proceed. A problem occurred with our Nikon slide scanner, which required that the unit be sent out for repair.

The scanner has been returned, but there is now a backlog of slides to be processed. There are a few bolt repairs that need to be done next season, and accurate descriptions of new plots will have to be made for Alegria, Carpinteria, and Paradise Cove. Work is proceeding on the creation of a new site description page as mentioned in the previous report. In upcoming quarters, we will be experimenting with the use of a new digital camera which might replace our current emulsion film cameras. We plan to use a new Dell computer with a high resolution flat panel display to score the digital photoplot images obtained by this camera.

Problems Encountered:

As mentioned previously the Nikon slide scanner malfunctioned and had to be sent out for repair. MMS paid for the repair charge directly.

MMS Action Required:

We are working with the rest of the intertidal inventory group to come up with a list of equipment needs to be purchased by MMS funds.

Task 17604: *Shoreline Inventory of Intertidal Resources of San Luis Obispo and Northern Santa Barbara Counties*

Principal Investigator: Pete Raimondi, Department of Biology, University of California, Santa Cruz, CA 95064

Major Accomplishments, January 1, 2002 - March 31, 2002

During the beginning of this quarter, photographic slides were scored for percent cover of species within photoplots and data collected during the previous quarter were entered into spreadsheets. The second part of the quarter was spent sampling all 10 study sites in San Luis Obispo (SLO) and Northern Santa Barbara Counties (SBC). Sampling occurred during March 11-13 and on March 24-27. All sampling was successfully completed. New *Lottia gigantea* plots were added at the Rancho Marino/Kenneth S. Norris Reserve in SLO Co. Formerly, only black abalone were monitored at this site.

Future Plans:

In the next quarter percent cover data from the photographic slides taken during this quarter will be entered along with field data into computer files. In addition, we will begin data analyses for the upcoming 10-year report that is due in Fall 2002

Estimated Percentage of Budget Expended: 75%

Task 17605: *Population Dynamics and Biology of the California Sea Otter at the Southern End of its Range*

Principal Investigators:
James Estes, Supervisory Wildlife Biologist, USGS-BRD; **Terrie Williams**, Professor of Biology, University of California, Santa Cruz; **Daniel Costa**, Professor of Biology, University of California, Santa Cruz; **Katherine Ralls**, Research Zoologist, Smithsonian Institution; **Donald Siniff**, Professor of Ecology, Evolution & Behavior, University of Minnesota

Major Accomplishments, January 1, 2002 - March 31, 2002:

Monitoring of study animals by radio telemetry continues by fieldworkers based at Piedras Blancas field station, San Simeon CA. A total of 10 of the original 15 study animals from the San Simeon group and 13 of the 14 animals from the Pt. Conception group still survive and are regularly monitored: 6 of the latter group have now returned to Cojo Cove, while the remaining 7 remain at locations between Fossil Pt. and Big Sur.

Sea otter captures were completed on schedule at San Simeon between March 18–25. Three of the previously TDR-equipped animals were re-captured and their TDR's recovered: 3 more recaptures will be attempted at a later date. A total of 19 new animals were captured: 15 of these were adults and were implanted with VHF radios, 7 of these with TDR's. The large male pup of one of the re-captured animals was also tagged and instrumented for further monitoring after weaning. Three other animals were flipper tagged only: one of these was a palpably pregnant female and 2 were juveniles.

The spring range-wide sea otter survey will be conducted in mid May. Beach walks for sea otter carcasses are ongoing: all collected carcasses are subject to detailed necropsies.

Problems Encountered:
A technical problem with the TDR units has been discovered: the problem involves the duty cycling feature of the instruments, and results in data collection being truncated prematurely due to battery passification. The manufacturer (Wildlife Computers Inc.) has taken full responsibility for this flaw and has agreed to replace each instrument with a new model (in which the design flaw has been rectified) free of charge. The new instruments will be deployed during year 3 of the project.

MMS Action Required:
No MMS action required. Increased sample sizes will more than compensate for any data loss due to instrument failure.

Future plans:
Work will proceed as proposed.

Estimated Percentage of Budget Expended:

Project Year 1	100%

Project Year 2	96%
Project Year 3	0%

Task 17606: *Population genetics of surfgrass (Phyllospadix torreyi) for use in restoration*.

Principal Investigators: Scott Hodges, Department of Ecology, Evolution and Marine Biology, **Douglas Bush**, Marine Science Institute, **Sally J. Holbrook,** Department of Ecology, Evolution and Marine Biology, and **Daniel Reed**, Marine Science Institute, University of California, Santa Barbara, CA 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

The major effort during this quarter was in computer analysis of AFLP fingerprints constructed for Goals 1 and 2 of our proposal. We have installed and started using new gel-scoring software ("SAGA" designed and marketed by LiCor Inc., Lincoln, Nebraska). We have now scored (i.e. counted bands in AFLP fingerprints) 10% of the DNA fingerprints on all samples collected for goals 1 and 2 of our proposal (about 50,000) bands. As we learn to use the software more efficiently, we expect our rate of analysis to increase significantly.

In addition, to our computer analysis of DNA fingerprints, we have extended our laboratory analysis of all 605 samples by constructing AFLP fingerprints using 4 more primer pairs. This makes a total of 10 different AFLP Fingerprints for every sample we have collected thus far. Our preliminary analysis of our data indicates that we may not need to make any new AFLP fingerprints to complete Goals 1 and 2 of our proposal.

Future plans:
The major effort in the next quarter will be divided between our on-going computer analysis of AFLP fingerprints, and laboratory work for the third (and last) goal of our proposal. This third goal aims to understand the genetic basis of sex determination in surfgrass. We will construct AFLP fingerprints on a new set of surfgrass samples for which the sex is known from flowering. After these AFLP fingerprints are made, we will clone AFLP fragments that are linked to sex (either male or female) and obtain DNA sequence that can be used in diagnostic tests to determine gender in surfgrass

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	21%xx

Task 17607: *Public Perceptions of Risk Associated with Offshore Oil Development*

Principal Investigator: Eric R.A.N. Smith, Department of Political Science, University of California, Santa Barbara, CA 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

Problems Encountered: None

MMS Action Required: None

Estimated Percentage of Budget Expended:
Project Year 1 xx83%

Task 17608: *Observing the Surface Circulation Along the South-Central California Coast Using High Frequency Radar: Consequences for Larval and Pollutant Dispersal*

Principal Investigators: **Libe Washburn**, Department of Geography, and **Stephen Gaines,** Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

During the quarter 1 January – 31 March 2002 we made progress in several aspects of our research program. An important development was that we re-installed two HF radars at our two northern sites, Pt. Arguello and Fallback 22 near Pt. Sal. These radars are on loan from the NOAA Environmental Technology Laboratory in Boulder Colorado at no cost to this project. We now have a total of five HF radars operating in our study area.

We are currently negotiating placement of a sixth radar in the eastern Santa Barbara Channel with California State Lands Commission (CSLC). The radar will be located on the Rincon Oil Island near Ventura. This site will extend our coverage to include most of the oil production platforms in the eastern Channel. So far we have received letters of support for installing the new radar from Rincon Island Limited Partnership and Sprint PCS Communications, the lessees of the Island. CLSC is the lease holder. We are now working to complete the application procedure with CLSC.

Another adjustment we are investigating to our radar array is the possible move of the Coal Oil Point radar to the US Coast Guard Santa Barbara Light facility at Santa Barbara Point. We anticipate better coverage in the eastern Channel with this move.

Edwin Beckenbach continues to work on his dissertation research which involves a 3-year time series of current patterns in the western Santa Barbara Channel. In the analysis he is focusing on two aspects of the circulation: 1) an interesting pattern of propagating eddy features which we hypothesize are topographic Rossby waves; and 2) the general circulation in the Channel and its relationship to local winds. A draft of a paper from aspect 1) is available entitled "Observations of wavelike circulation using HF radar in the Santa Barbara Channel, California during 1998-2000.

In another study Cynthia Cudaback (a UCSB researcher), Edward Dever, and I used a combination of HF radar and moored current data to examine flow over the inner shelf in the Santa Barbara Channel and Santa Maria Basin. A manuscript describing our findings entitled "Inner shelf circulaton near Pt. Conception California" by Cudaback, Washburn, and Dever was recently submitted to Continental Shelf Research.

During the Ocean Sciences Meeting in Honolulu from 11-15 February 2002 the following presentations related to our project were made:

2002 "Observations of Wavelike Phenomena in the Santa Barbara Channel Using HF Radar", Beckenbach, E.H. and L. Washburn, Ocean Sciences Meeting, 11-15 February, Honolulu, HI.

2002 "Pollution Hazards off the Southern California Coast: Satellite and In-Situ Observations of Naturally Occurring Oil Seepage and Storm Water Runoff Plumes", DiGiacomo, P. M., B. Holt, and L. Washburn, Ocean Sciences Meeting, 11-15 February, Honolulu, HI.

2002 "An Observational Network for Multidisciplinary Time Series on the Central California Coast", Washburn, L., S. Gaines, E. P. Dever, and D. Reed, Ocean Sciences Meeting, 11-15 February, Honolulu, HI.

Action requested from MMS: We request that MMS resume our helicopter flights to Pt. Conception to maintain our HF radar site there. This maintenance is essential to our project.

Estimated Percentage of Budget Expended:

Project Year 1 100%
Project Year 2 xx32%

Task 17609: *Advancing Marine Biotechnology: Use of OCS Oil Platforms as Sustainable Sources of Marine Natural Products*

Principal Investigators: **Russell J. Schmitt**, Department of Ecology, Evolution and Marine Biology, **Jenifer Dugan**, Marine Science Institute, **Scott Hodges,** Department of Ecology, Evolution and Marine Biology, **Robert Jacobs,** Department of Ecology, Evolution and Marine Biology, **Mark Page**, Marine Science Institute, **Leslie Wilson,** Department of Molecular, Cellular and Developmental Biology, and **Stephen Gaines,** Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

PHARMACOLOGY

Marine organisms that inhabit the subtidal structures of offshore oil production platforms are a potential source of novel compounds for pharmaceutical use. These organisms provide an unparalleled opportunity to study natural product chemistry from populations of organisms living in ecologically unique habitats. Since the last progress report, we have studied the natural product potential of the sea anemone *Metridium exiles, Corynactus californica* and *Metridium senile* and have further investigated the molecular mechanism of action of coumarin compounds. *Metridium exiles* is found exclusively on platform Gail. Samples were collected using SCUBA. Sea anemones were kept alive in running seawater, removed from their substrate and flask frozen in liquid nitrogen. Frozen anemones were homogenized in filtered seawater in a blender and the homogenate was extracted into two phases: a lipid/organic extract and a water/methanol extract. Extracts were catalogued and weighed and stored at –80° C .

Biological Activity of *Metridium exiles*

Extracts of the sea anemone *Metridium exiles* were prepared and tested for the second time in the sea urchin embryo assay to confirm previous results. The crude organic extract was active in inhibiting the first cleavage of sea urchin embryos division in a concentration dependant manner with 50% inhibition occurring at approximately 118 ug/ml (Figure 1). To begin bioassay guided fractionation, the crude extract was fractionated into fractions with differing polarities. A hexane fraction, a chloroform fraction, an ethyl acetate fraction, and a methanol/water fraction were prepared and tested in the sea urchin embryo assay. Activity was retained and localized to the ethyl acetate fraction. A dose response curve is currently being prepared and further fractionation of the ethyl acetate extract will be accomplished on normal phase HPLC.

Other Sea Anemones

Organic extracts of the sea anemone *Corynactus californica* and *Metridium senile* inhibited division of the sea urchin embryo. Chloroform extracts of *Corynactus californica* showed 96.7% inhibition and activity as low as 50 ug/ml. Dose response curves are currently being prepared. Crude extracts of *Metridium senile* had 98% inhibition.

Biological Activity of Coumarin Compounds Related to Metabolites of *Dasycladalus* Species (siphonous green algae):

Since the last report, we have investigated whether dicoumarol, (a natural coumarin anticoagulant chemically designated as 3,3'-methylenebis[4-hydroxycoumarin), directly affected microtubule polymerization. Light scattering assays (Figure 2) show that that in the presence of dicoumarol, the rate and extent of microtubule polymerization *in vitro* is induced in a concentration dependent manner. Turbidity and sedimentation assays of dicoumarol showed an increase in polymer mass (Figure 3). In addition, electron micrographs revealed that dicoumarol increases the microtubule number concentration and drastically lowers the mean length of the microtubules (Figures 4 and 5). These data suggests that dicoumarol, in addition to potently stabilizing microtubule dynamics, is also effective in nucleating tubulin assembly and thus prevents polymer disassembly.

Recent clinical trials have indicated that combinations of anti-mitotic drugs results in increased anti-tumor activity and decreased toxicity (Hudes et al., 1992, 1997; Seidman et al., 1992). Combination therapy with drugs that stabilize microtubule dynamics by different mechanisms may improve responses and minimize side effects of the individual drugs even further. This hypothesis is supported by our finding that the combination of paclitaxel with dicoumarol is synergistic in the sea urchin cell division assay (Figures 6 and 7). This suggests that these agents may work synergistically and have the potential to be used together as chemotherapeutic agents.

In summary, we have shown that dicoumarol has a unique action on microtubule dynamics. Because of its low toxicity and simple chemical structure, there is potential for combining coumarin with chemotherapeutic and/or biological agents in an attempt to improve efficacy. It would be of great interest to clinically explore combinations of coumarin with other microtubule stabilizing agents. We believe this pharmacophore represents a unique model for development of new avenues of cancer chemotherapy.

Figures

Figure 1: *Metridium exiles* extract inhibition of sea urchin embryo division. The IC_{50} is 118 ug/ml

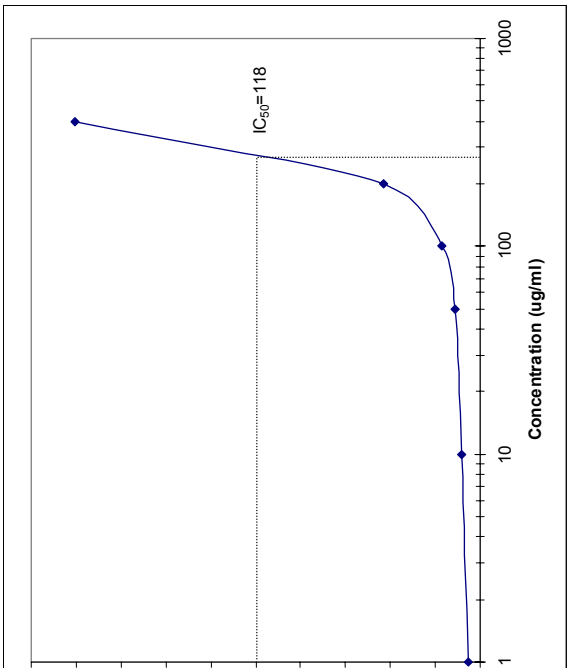


Figure 2. Effects of Dicoumarol on Microtubule Polymerization

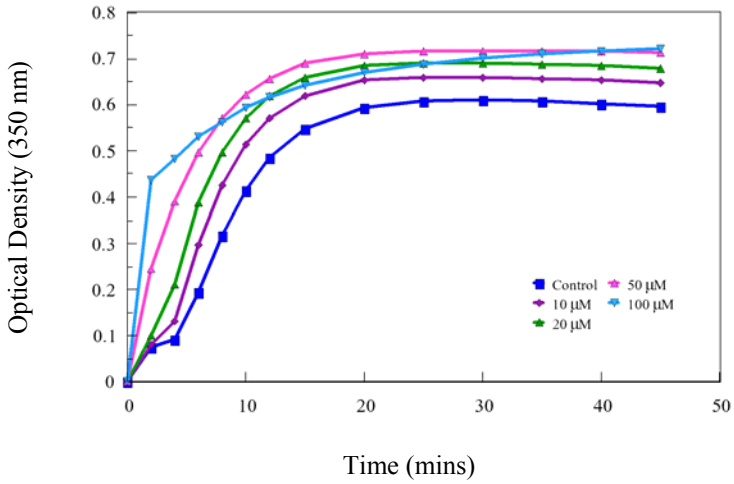


Figure 3. Effects of Dicoumarol on on Microtubule Polymer Mass Concentration

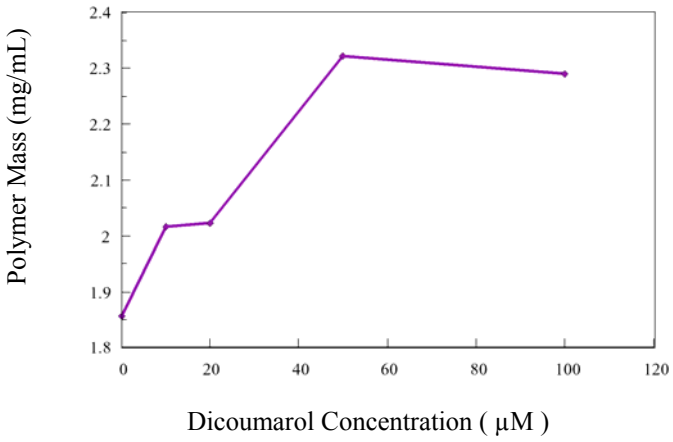


Figure 4. Effects of Dicoumarol

Length and Number

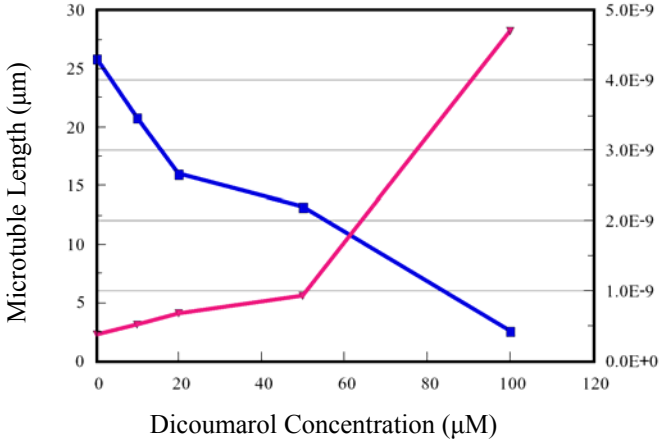


Figure 5. Alterations of Taxol Potency on Sea Urchin Cell Division by Dicoumarol

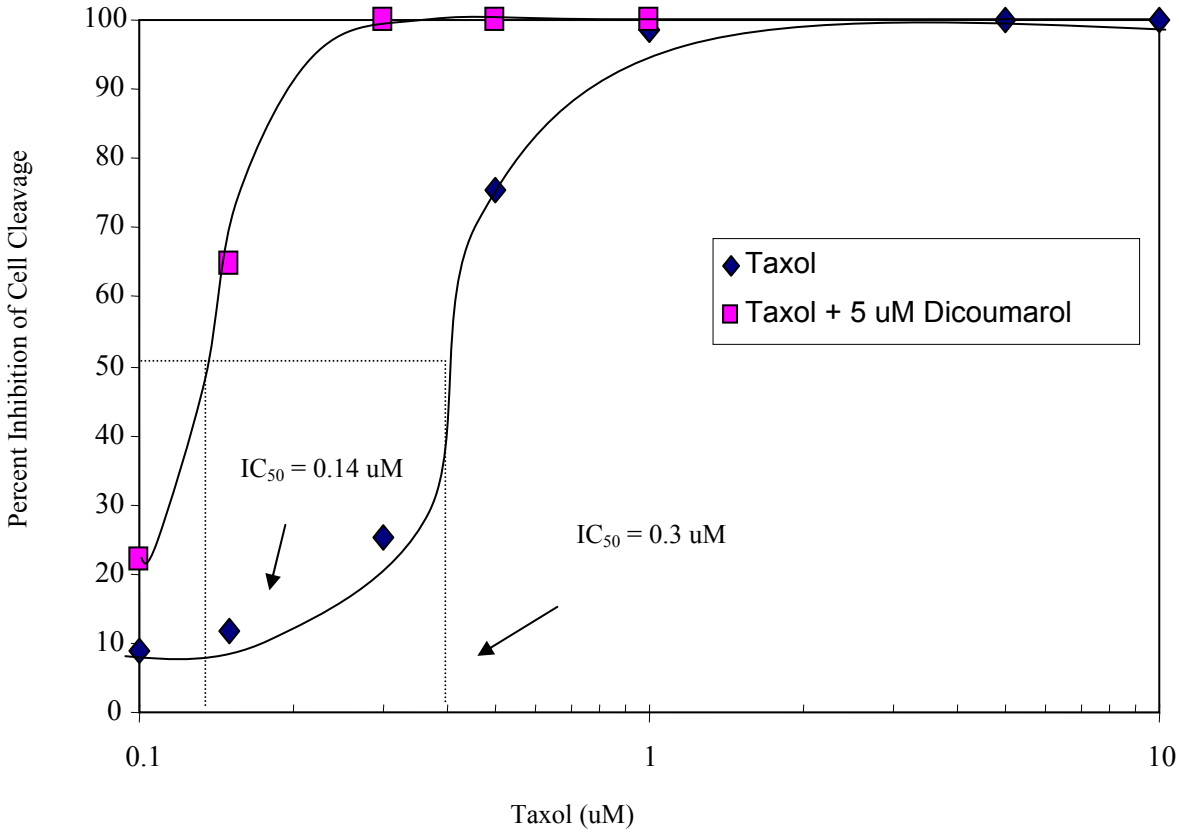
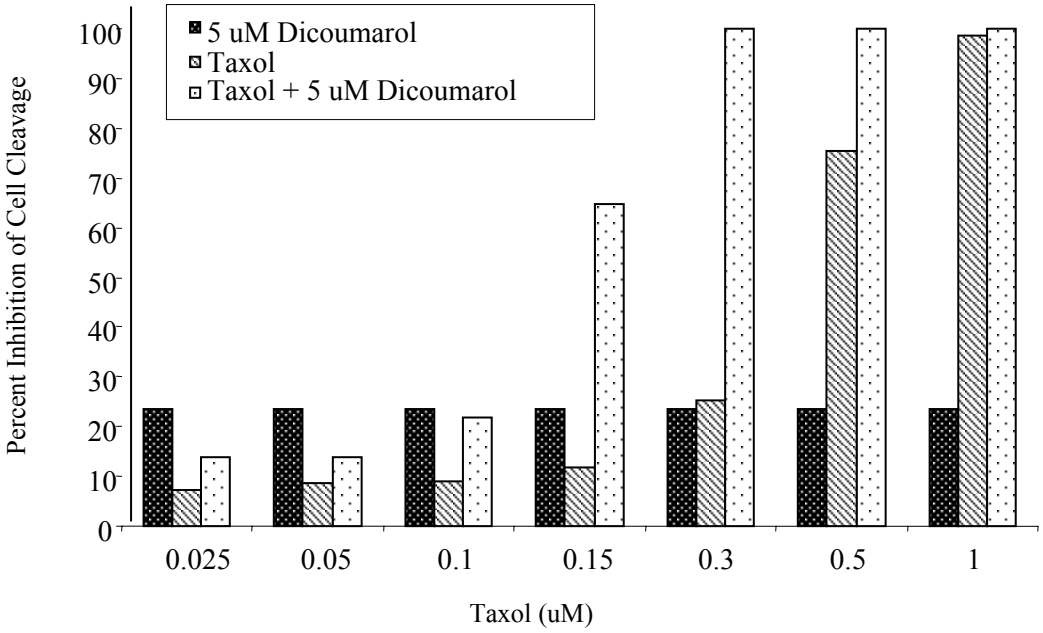


Figure 6. Synergistic Effects with Taxol and Dicoumarol



GENETIC

During this quarter we made important progress in our identification and localization of the cryptic species of *Bugula neritina* that produces the potential anticancer drug, Bryostatin 1. We have now sampled *B. neritina* on three different OCS platforms (Houchen, Hogan and Holly). Using PCR-RFLP on the cytochrome oxidase I (COI) gene of the mitochondrial DNA (mtDNA), we have shown that on these platforms, at depths between 20 and 60 feet, all *B. neritina* are of the 'deep' type that produce Bryostatin 1 Davidson & Haygood (1999). Furthermore, we have also confirmed (using PCR-RFLP of the small subunit of the ribosomal RNA gene) that the strain of symbiotic bacterium harbored by these samples is the same as that was previously described by Davidson & Haygood (1999).

One of the goals of our project is to determine whether the population genetic structure of *Bugula neritina* 'deep' on OCS platforms is similar to that on natural reefs. To accomplish this we have searched for a region of the mtDNA genome that harbors DNA sequence variation. Unfortunately, the COI gene region, used to distinguish between the two cryptic species does not harbor variation among the 'deep' species of *B. neritina*. Therefore we have attempted to PCR amplify and sequence other regions of mtDNA that may contain variation among samples. We have tried four different primer combinations to PCR amplify the cytochrome b region as well as primers for the COI-COII intergenic region and the COIII region. We utilized 'universal' primers designed from organisms phylogenetically distant to bryozoans and none of the primers have either produced PCR amplification at all or weakly produced amplification products that were not the expected

size. Because little molecular work has been performed on the Phylum Bryozoa, no specific primers for these regions were available.

We have now tried to amplify the region between the COI gene and the 16S ribosomal RNA gene of the mtDNA. Because a 16S gene sequence was available from Genebank and we had directly sequenced the COI gene, we designed specific primers to amplify between these two genes. Using this strategy, we were able to amplify a 1.5 Kb region of DNA. We then PCR amplified, cloned, and sequenced this region for a sample of both the 'shallow' and 'deep' species of *B. neritina*. From these sequences we then designed specific primers for sequencing larger numbers of samples. To date we have now sequenced 1425 base pairs from this region from four *B. neritina* 'deep' samples (from Platform Houchen, Santa Cruz Island, Anacapa Island, and Loon Pt (near Carpinteria). We have detected sequence variation among all four samples. Pairwise comparisons among these samples show from 2 to 30 site differences (0.1-2.1%). Thus, we have now identified a mtDNA region that contains sufficient variation among *B. neritina* 'deep' samples to measure population genetic structure.

Future plans:
During the next quarter we plan to extract DNA from population samples of *Bugula neritina* 'deep' samples collected from OCS platforms as well as natural reefs both along the Santa Barbara Co. coastline and along the Channel Islands off the coast (Anacapa & Santa Cruz Islands). We will begin sequencing the mtDNA region to identify sequence variation and to determine the frequencies of each of the mtDNA types we find.

Estimated Percentage of Budget Expended:
Project Year 1 73%xx

y (350 nm)

Task 17610: *Joint UCSB-MMS Pacific OCS Student Internship Program*

Principal Investigators: **Jenifer Dugan**, Coastal Research Center, Marine Science Institute, University California, California. 93106, and **Edward A. Keller**, Environmental Studies Program, University of California, Santa Barbara, California, 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

Four interns worked on MMS projects during Winter '02 and two new positions were advertised. Ms. Regina Butali continued to work with Michael McCrary at MMS, USGS-BRD personnel and NPS personnel entering data from aerial surveys and monitoring of seabirds in the Santa Barbara Channel. Tim Wolff was hired to work with Ms. Barminsky and Mr. Brickey of MMS on a regional database for use in site-specific geological and engineering evaluation of producing offshore fields in the Santa Maria Basin, Santa Barbara Channel and offshore Long Beach in January 2002. We readvertised for the second position in January 2002 also. Mike Williams and Jason Chau continued to work with Dr. Jim Lima of MMS to support the MMS archeology program. We readvertised the new internship for a graduate student to work on curricula development at the Santa Barbara Maritime Museum. We also advertised for an intern to work with Cathy Hoffman and Glenn Shackell of MMS on developing pipeline maps, critical lengths and inspection results. We will readvertise both positions at the beginning of the Spring 2002 term. We are working with Fred Piltz and other MMS personnel to arrange additional internship opportunities for MMS/CMI projects during Spring and Summer 2002.

We are coordinating with Mary Elaine Dunaway to have the presentations based on results of CMI/SCEI studies given at the Western Society of Naturalists meetings in Fall 2001 presented at MMS headquarters by students and PI's during Spring 2002.

Future plans:

New interns will be hired as needs are identified.

Estimated Percentage of Budget Expended:

Project Year 1: 100%
Project Year 2: xx25%

Task 17610: *Industrial Activity and Its Socioeconomic Impacts: Oil and Three Coastal California Counties*

Collaborating Scientist: Michael R. Adamson, Research Assistant, Marine Science Institute, University of California, Santa Barbara, CA, 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

xxThe collaborating scientist has completed all of the research that will be used to write the report. This has included a review of prior work, substantial reading in relevant secondary sources, research into trade journals and company publications, limited archival research, and an in-depth review of oil and gas publications produced by the state regulatory agency.

The collaborating scientist has nearly completed a report that reviews, summarizes, reevaluates, and reinterprets prior findings, and discusses present and future scenarios relevant to policymaking in the context of recent technological developments and changes in local industry structure. This initial draft of the study will be completed and distributed in January 2002.

An extension of the project has been requested to accommodate the review and revision process.

The title of the project has been modified to reflect more accurately the content of the report (see above).

Estimated Percentage of Budget Expended:

Project Year 1: 90%

Task 17611: *Simulation of a Subsurface Oil Spill by a Hydrocarbon Seep (SSOS-HYS)*
and
Task 18211: *Oil Slicks in the Ocean: Predicting their Release Points Using the Natural Laboratory of the Santa Barbara Channel*

Principal Investigators: **Jordan Clark,** Department of Geological Sciences, **Bruce Luyendyk**, Department of Geological Sciences, and **Ira Leifer**, Institute of Crustal Studies, University of California, Santa Barbara, California 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

Estimated Percentage of Budget Expended:
Project Year 1: xx95%

Task 18212: *Transport over the Inner-Shelf of the Santa Barbara Channel*

Principal Investigator: Carter Ohlmann, Institute of Computational Earth System Science, University of California, Santa Barbara, California 93106

Major Accomplishments, January 1, 2002 - March 31, 2002

Introduction: The primary goals of this research are to collect surface current data over the inner-shelf of the Santa Barbara Channel with Pacific Gyre's "Microstar" Lagrangian drifters, and use the data to: identify characteristic features of the flow field such as convergences, divergences and cross shelf transports, determine the surface velocity and velocity variance distributions, examine flow patterns on scales that are too small to be resolved in CODAR current measurements, and investigate how well particle paths determined from Eulerian CODAR fields represent measured Lagrangian flows.

Progress (January 1, 2002 – March 31, 2002): The two primary achievements reported last quarter have further evolved. Specifically,

- A full day test deployment of 4 Microstar drifters was successfully carried out within the Santa Barbara channel study region.

- A first cut at coding a Matlab routine for calculating particle trajectories from CODAR fields has been made.

Communication "handshaking" issues have been sorted out since the last drifter test. On February 1, 2002 the first true "deployment" of Microstar drifters occurred. Three drifters were deployed from a skiff along the 50 m isobath, off Naples, just west of Coal Oil Point. The drifters were deployed near 0830 hours, roughly 1 km apart. At about 1400 hours, the skiff returned to the area and successfully recovered all the drifters (the last position of each drifter was reported to the skiff driver as he approached the deployment region). A qualitative comparison between the drifter tracks and CODAR velocities for the region shows poor agreement, presumably due to the difference in spatial resolution afforded by each measurement device. Drifters for the first year's experiments are presently under construction (by Pacific Gyre Corp).

Comparison of Lagrangian drifter data with Eulerian CODAR data requires that Eulerian fields be created from the drifter data, and that Lagrangian trajectories be determined from the CODAR data. A simple first order Euler integration and a more complex fourth order Runge Kutta scheme have been coded in Matlab.

Estimated Percentage of Budget Expended:

Project Year 1: xx10%

Task 18213: *Use of Biological Endpoints in Flatfish to Establish Sediment Quality Criteria for Polyaromatic Hydrocarbon Residues and Assess Remediation Strategies*

Principal Investigator: Daniel Schlenk, Department of Environmental Sciences, University of California, Riverside, Scott Steinert CSC, Marine Sciences Department

Major Accomplishments, January 1, 2002 - March 31, 2002

Our first task was to generate concentration-response curves in laboratory studies with various PAH-contaminated sediments from Southern California and biochemical indicators of PAH exposure in flatfish. Sediments were collected from a oil seep near Santa Barbara (Coal Oil Point) and a location relatively free of PAHs. The sediments were diluted into 0, 33 67, and 100 percentages of the seep sediment. Horneyhead turbot were exposed for one week and feed throughout the exposure. Animals were euthanized and livers/blood removed. Initial data indicate a dose-dependent increase in DNA damage in the liver. We are currently measuring CYP1A expression and fluorescent aromatic compounds (FACs) from the bile.

Problems Encountered:
Finding a location to carry out the exposures. After being evicted from the Cal-Tech laboratory in Corona Del Mar. The exposures were conducted at the Southern California Coastal Water Research Project in Westminister.

MMS Action Required:
No MMS action required.

Future plans:
Work will proceed as proposed.

Estimated Percentage of Budget Expended:

Project Year 1	25%